

Remarks

Currently pending in the application are claims 30-44. Support for new claims 31-44 can be found at, for example, paragraphs [0018] – [0021] and Examples 1-21 of the published application. No new matter has been added. In view of the amendments above and following remarks, Applicants respectfully request reconsideration by the Examiner, and advancement of the application to allowance.

35 U.S.C. § 103

The Examiner has rejected claims 16-28 and 30 under 35 U.S.C. § 103(a) as being unpatentable over Mackawa et al. (US 2002/0040098) in view of Eichorst et al. (US 2001/0019813) and further in view of December et al. (US 6,471,843). Applicants traverse these rejections for the following reasons.

According to claims 31-44 of the present application, a non-isocyanate based polyurethane product is obtained from the reaction of: (a) one or more polymerisable organic materials having at least one cyclocarbonate group; (b) at least one nano-clay having a platelet thickness of less than 25 Å and an aspect ratio higher than 10 or a nanocomposite formed from the nano-clay; and (c) at least one hardener. Claim 30 is directed to a method for forming such a non-isocyanate based polyurethane.

In comparison, Mackawa et al. teaches one of the following combinations of compounds in an aqueous composition:

1. a block polymer containing olefin monomer units and vinyl monomers (I) + a polyurethane formed from conventional isocyanates and polyols (II);
2. block polymer (I) + a vinyl polymer (III); and
3. block polymer (I) + a tackifier (IV).

See Maekawa et al. at paragraphs [0009]-[0011].

With regards to combination 1, Maekawa et al. does not teach or suggest adding particles/platelets of clay during the reaction of the isocyanates and polyols when forming polyurethane (II). Rather, and as the Examiner points out, the particles/platelets of clay are added to the aqueous composition of block polymer (I) + already formed polyurethane compound (II). *See id.* at paragraphs [0076] and [0079]. Thus, the conventional polyurethane in Maekawa et al. and its method of formation are substantially different than those presently claimed.

Eichorst et al. teach the addition of platelets of clay of a certain thickness and diameter to an electrically conductive layer containing a sulfonated polyurethane binder. The sulfonated polyurethane binders taught in Eichorst et al. are also produced from isocyanates. *See Eichorst et al.* at paragraph [0044]. Eichorst et al. neither teaches nor suggests forming sulfonated isocyanate based polyurethanes in the presence of the platelets of clays or that sulfonated isocyanate based polyurethanes could be substituted with sulfonated non-isocyanate based polyurethane.

The Examiner has further added December et al. for teaching non-isocyanate based polyurethanes and urges one of ordinary skill would have found it obvious to combine the non-isocyanate based polyurethane in December with the composition of Maekawa et al. However, were one to make this combination, he still would not arrive at Applicants presently claimed invention.

In particular, December et al. teach a non-isocyanate based polyurethane coating obtained by reacting three specific components: (A) a polymer containing at least one primary carbamate group and at least one cationic salting site; (B) a curing agent; and (C)

a compound having a MW of 131-2000 and at least one primary carbamate group and at least one branched or straight chain alkyl group. *See December et al.* at col. 2, ls. 55-68. December et al. neither teaches nor suggest including particles/platelets of clay in the reaction when forming the polyurethane coating. Thus, if one were to substitute the isocyanate based polyurethane in Mackawa et al. with the non-isocyanate based polyurethane coating in December et al., one would arrive at:

1. An aqueous composition containing: the block polymer (I) + a non-isocyanate based polyurethane coating formed from the three components (A), (B) and (C) above.

The publications cited above further teach that platelets/particles of clay could then be added to the aqueous composition of 1.

Applicants presently claimed product and method are clearly distinguished over those taught in these publications since, during the formation of the non-isocyanate based polyurethane, Applicants disperse a nano-clay having a platelet thickness of less than 25 Å and an aspect ratio higher than 10 or a nanocomposite formed from the nano-clay to form a polyurethane having substantially better physical and mechanical properties than conventional isocyanate based or non-isocyanate based polyurethanes.

As further evidence that Applicants claimed polyurethane product and method of its formation are clearly distinguished over those taught in the publications cited above, Applicants respectfully direct the Examiner's attention to the Examples in the present application in which the physical and mechanical properties of conventional non-isocyanate based polyurethanes (Examples 16, 17 and 18) are compared against nanoclay-containing non-isocyanate based polyurethanes prepared according to the

present invention (Examples 19, 20 and 21). To assist in comparing the polyurethanes in the examples:

Non-Isocyanate PU (comparative) Non-Isocyanate PU (present invention)

Example 16	v.	Example 19
Example 17	v.	Example 20
Example 18	v.	Example 21

As Tables 5, 6, 8, 9 and 10 demonstrate, the non-isocyanate based polyurethanes of the present invention provide significantly reduced gel times, water uptake and deformation as well as increased lap shear strengths. For instance, the following tables summarize these unexpected results for inventive polyurethane Example 19 as compared against conventional polyurethane Example 16:

Table 1

Property	Example 16 (comparative)	Example 19	% Improvement
Gel Time (min)	155	135	13
H ₂ O Uptake (%)	25.9	20.6	20

Table 2 (Cured for 1 day at Room Temperature)

Property	Example 16 (comparative)	Example 19	% Improvement
T _g (°C)	-19	-9	52
Lap Shear Strength (MPa)	1.04	1.78	71
Deformation (mm)	0.45	0.43	4.4

Figures 1 and 2 further provide evidence that the reaction times for the inventive non-isocyanate based polyurethanes are substantially reduced as compared to those not obtained in the presence of the nanoclay. As shown in Figure 1, the absorption at 1795 cm^{-1} attributed to the carbonyl of the cyclocarbonate groups is almost three times less for the inventive non-isocyanate based polyurethane (NPU-1) as compared to the comparative non-isocyanate based polyurethane (RPU-1). Moreover, reaction was complete for the inventive non-isocyanate based polyurethane within 4 days while the comparative required 8 days. *See present application* at paragraph [0126].

The surprising results above are neither taught nor fairly suggested in the publications cited above nor were they expected by the Applicants. Accordingly, Applicants submit that claims 30-44 are not obvious in view of the publications cited above and respectfully request the rejections under 35 U.S.C. § 103(a) be withdrawn.

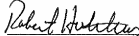
Conclusion

Applicants respectfully submit that the application is now in condition for allowance, and respectfully request an issuance of a Notice of Allowance directed towards the pending claims.

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Respectfully Submitted,



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Date: 4/9/09